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MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—An epitome of the various facts known to petrographers with relation to the act of crystallization in rock magmas, and the conditions under which this takes place, has been sorely needed by students who are unable to keep abreast of the widespread literature of modern lithology. Mr. Iddings[2] has recently succeeded in presenting the subject to us in a manner that is at the same time scientific and untechnical. His work will surely be appreciated by all of his co-laborers in petrography, as well as by students and geologists at large. Mr. Iddings' paper is divided into two distinct parts. In the first the phenomena of crystallization are discussed, with especial reference to the crystallizations of mineral in rock magmas. The second portion of the article deals with the causes of crystallization; and in this it is that the author has given the most valuable results. After mentioning the cases in which rocks and rock-forming minerals have been artificially produced, and calling attention to the analogy that exists between the originally molten rock-magma and saturated solutions of salts, it is concluded that (1) the order of crystallization in rocks depends primarily upon their chemical composition, and (2) its nature upon the physical conditions obtaining during the solidification; the principal physical conditions affecting crystallization, in the order of their importance, being temperature, rate of cooling, chemical composition of the original magma, the presence of mineralizing agents (aiding in the formation of crystals, *e. g.*, water in many rocks), and finally pressure. The effect of each one of these conditions is briefly alluded to, and the impression which each leaves upon the cooling magma during its progress from the interior of the earth to its surface is clearly described. In the course of the article the word *phenocrysts* is suggested as an equivalent for the German word "Einspringlinge,"—porphyritic crystals.—— The controversy between Prof. Judd and Dr. Geikie as to the origin of the massive rocks of the Western Isles of Scotland has been intensified by the appearance of Geikie's[3] "History of Volcanic Action During the Tertiary Period in the British Isles," and a reply to this by Prof.

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Maine.

[2] On the Crystallization of Igneous Rocks. Phil. Sec. of Wash. Bull., Vol. XI., pp. 65–113.

[3] Trans. Roy. Soc. Edinb. XXXV., pt. 2, pp. 21–184.

Judd.[4] It will be remembered that Judd,[5] in 1874, published an article in which was shown that there exist in the Western Isles of Scotland granites and gabbros, grading imperceptibly into vitreous pitchstones and tachylites, and emanating from five distinct centres, which were regarded as the seats of old volcanoes. The acid rocks of the region were regarded as older than the basic ones, and the district was thought to have been one of great volcanoes. In Dr. Geikie's monograph the last two conclusions are denied acceptance, while on the whole the first two are accepted. In his present article Judd gives his reasons for insisting upon the truth of his previous statements, and refuses to accept the view of Geikie that the great outbursts of lava took place from fissures (as in the Western States), rather than from volcanic vents. According to Judd the gabbros are the deep-seated portions of a magma, which, upon the surface, assumed the structure of basalt. This gabbro filled the fissures which were opened during the extravasation of the basalt, and is therefore contemporaneous with this rock. Geikie asserts that the gabbro injections belong to a distinct and later period than the outflow of the basalt. The controversy bids fair to yield results of great interest to petrography; for this reason it has been referred to in this place. The acid rocks of this region present some very interesting appearances, which are described by Judd[6] in a short paper. Granitic eruptive masses usually pass towards their peripheral portions into granophyres, smaller eruptive bosses and laccolites exhibit the granophyric structure throughout; while apophyses from intrusive masses display the same structures, sometimes on a very minute scale. A labradorite-andesite is composed of large crystals of labradorite scattered through a glassy base containing microlites of feldspar, augite and magnetite. In a specimen of this rock from Dun da Ghaoithe in Mull are large idiomorphic labradorite crystals, consisting of a central, sometimes rounded and corroded, core surrounded by an irregular fringe of the same mineral substance,[7] differing from the core in extinction and in other properties. This enlargement takes place only where the original crystal was in contact with the glassy matrix. The crystallographic continuity of the core and the surrounding envelope is shown by the passage of twinning planes from the one into the other; the optical

[4] The Tertiary Volcanoes of the Western Isles of Scotland. *Quart. Jour. Geo. Soc.*, May, 1889, pp. 187–219.

[5] Ib. XXX. [1874], pp. 220–302.

[6] *Quart. Jour. Geo. Soc.*, May, 1889, pp. 175–187.

[7] cf. AMER. NATURALIST, 1885, p. 1216; 1888, pp. 168 and 732.

differences by the extinction of the envelope in zones whose angle of extinction varies *gradually* and progressively from the centre outward, reaching finally (in some cases) the albite limit. This enlargement is regarded by the author as having taken place after the solidification of the rock, and at the expense of the glassy matrix. Further, the granophyric structure is supposed to owe its origin to a similar set of phenomena, viz., the secondary devitrification of a glassy matrix. A third very interesting article by the same writer[8] treats of the processes by which the plagioclase of the Oedegaarden "gepleckter-gabbro" has been changed into scapolite. In the fresh rock a labradorite with twinning lamellæ is distinctly observed. Along these twinning bands are accumulations[9] of cavities containing solutions of sodium chloride. As the rock loses its granitic structure and becomes schistose the feldspar loses its distinctive features, becomes granulated, and changes gradually into scapolite, at the same time losing its store of sodium-chloride solution. The production of the cavities with their contents of sodium-chloride is supposed to be the result of statical pressure — the solution having penetrated the mineral along its planes of easiest solution. Under the influence of mechanical stress the mineral was crushed and suffered granulation, reactions were set up between the feldspar molecules and the included sodium-chloride solution, resulting in entire conversion of the plagioclase into scapolite. The augite of the same rock presents a parallel series of changes. It first becomes schillerized, and then, by mutual reactions between the augite substance and the material producing the schillerization, is changed into hornblende. It is pointed out by the author that similar changes must have taken place in the Canadian scapolite rocks studied by Messrs. Adams and Lawson.[10] Prof. Judd would call the first kind of change "*statical metamorphism*," since the production of secondary cavities in minerals and schillerization are the result of solutions acting on mineral substances under the influence of heat and pressure. "Dynamical metamorphism," on the other hand, necessitates movement in the mass, with the accompaniment of the crushing of minerals and the production of schistosity. A comparison of the effects of the two kinds of metamorphism is briefly given by the author in a separate paper.[11]

[8] *Mineralogical Magazine*, VIII., pp. 186–202.

[9] cf. AMER. NATURALIST, 1887, p. 761.

[10] AMER. NATURALIST, Feb. 1889, p. 169.

[11] *Geological Magazine*, VI. 300, pp. 243–249.

A little south of Murfreesboro, in Pike county, Arkansas, is a mass of peridotite of Cretaceous age, whose microscopical features have recently been examined by Dr. R. N. Brackett.[12] The rock consists of porphyritic crystals of colorless olivine and brown mica in a ground-mass composed of lath-shaped crystals of augite, little crystals of peropskite and grains of magnetite in a decomposed yellowish glassy base. The rock is similar in many respects to the only other two peridotites described from the United States. It is placed by the author in the group of kimberlites or picrite-porphyries of Lewis. The ore-bearing rock at the Treadwell gold mine in Alaska is, according to F. D. Adams,[13] "A hornblende granite, much crushed, altered and impregnated with secondary quartz, calcite and pyrite." This includes kernels of more compact granite in which alteration has not proceeded so far. Much of the gold present in the rock occurs free in the pyrite. The rock is interesting in that it contains original epidote. Interesting intergrowths of the rare mineral allanite and epidote are described in some detail by Dr. Hobbs[14] in a porphyritic granite at Ilchester, Md., and by Lacroix[15] in the pyroxene-amphibole gneiss of Finisterre, in the pyroxene-wernerite gneiss of the Lower Australian Waldviertel, and in the scapolite-gneiss of Odegärden in Norway. These intergrowths (in the Ilchester rock) consist of an idiomorphic core of brown allanite, zonally developed, and around it an idiomorphic or an allotriomorphic mantle of pale yellowish green epidote. In the allanite the axis of elasticity is inclined at an angle of 36° to the vertical axes, while in the epidote this is only 3°. Analysis of the purified epidote yielded Dr. Hildebrand:

SiO_2	Fe_2O_3.FeO	MnO	CaO	MgO	H_2O	P_2O_5	TiO_2
37.63	15.29	.31	22.93	.31	2.23	.44	3.78

Dr. Hobbs regards the epidote as secondary in the Ilchester rock, while Lacroix thinks it primary in all the occurrences described by him.

Mineralogical News.—In a short paper forming an appendix to his notes on the minerals occurring in the neighborhood of Baltimore, Dr. Williams[16] briefly mentions fifteen new species that have been

[12] *Amer. Jour. Sci.*, XXXVIII., July, 1889, p. 56.

[13] *American Geologist*, Aug., 1889, p. 84.

[14] *Amer. Jour. Sci.*, XXXVIII., Sept., 1889, p. 223.

[15] *Bull. de la Soc. Franc. de Min.*, XII., April, 1889.

[16] Johns Hopkins Univ. Circulars, No. 75.

identified in the region within the past two years. Among these is *ottrelite* from certain phyetites occurring at an old copper mine near Liberty, Frederick county. The crystals of the mineral are arranged nearly perpendicular to the cleavage planes of the rock. Their morphological and optical properties leave no doubt as to their true nature. In addition to the minerals described by Williams, Mr. Gill[17] describes two very rare chromium minerals found in the dump heaps of the chrome pits in Montgomery county. The first is a *chrome tourmaline.* This occurs in fissures in chromite, and is generally associated with *fuchsite,* both usually being imbedded in a chloritic matrix. The tourmaline is in the form of long dark green needles, exhibiting marked dichroism in green and straw-colored tints, and a beautiful zonal structure. The fuchsite is in little green scales, whose optical angle in air is 68° 16′ for sodium light, and pleochroism: A=robin's egg blue, B=yellowish green, C=bluish chrome-green. Analyses of the two minerals, made by Dr. Chatard, are given below. I. is that of the tourmaline, II. is the analysis of the fuchsite.

	SiO_2	B_2O_3	Fl	P_2O_5	TiO_2	Al_2O_3	Cr_2O_3	Fe_2O_6	NiO	CaO
I.	36.56	8.90	.06	.04	.09	32.58	4.32	.79	.05	.75
II.	42.21	. . . . .				34.55	2.03	1.03		.47

MgO		Na_2O	K_2O	H_2O	Sp.Gr.
9.47	I.	2.22	.13	3.74	3.062-3.089
3.13	II.	.82	9.16	6.77	. . . . .

Analyses and short descriptions of three other rare substances are communicated by Dr. Genth;[18] Gadolinite from Burnett and Llano counties, Texas, has a black color, is translucent in thin splinters, and has a greenish gray streak. Analysis of a specimen of the Burnett county mineral gave:

SiO_2	Al_2O_3	Ce_2O_3	ThO_2	$(Di.La)_2O_3$	$(Y.Er)_2O_3$	MnO	FeO
22.87	.28	2.65		5.22	44.35	.22	13.69

BeO	MgO	CaO	Na_2O	K_2O	Ign.	Sp.Gr.
9.24	.07	.64	.20	.15	.72	4.201.

Cacoclasite is the name suggested by H. C. Lewis for some tetragonal white crystals present in a blue calcite at Wakefield, Ottawa county, Quebec. Dr. Genth's analyses indicate that the substance is a mixture of several compounds whose nature cannot be determined. A

[17] Ib. p. 75.

[18] *Amer. Jour. Sci.*, Sept., 1889, p. 198.

monazite from the Villeneuve Mica Mine, Ottawa county, Quebec, has a reddish-brown color, slightly waxy lustre, and an indistinct cleavage. Analysis:

SiO_2	ThO_2	Fe_2O_3	Ce_2O_3	$(La.Di)_2O_3$	$(Y.Er)_2O_3$	MgO	CaO
.91	12.60	1.07	24.80	26.41	4.76	.04	1.54

P_2O_5	H_2O	Sp.Gr.
26.86	.78	5.233

Galmite and a *columbite* crystal from Delaware county, Pennsylvania, are also described and analysed by Dr. Genth.[19]

BOTANY.

The Cooke Herbarium.—From the June number of *Grevillea* we learn that the large herbarium of fungi, transferred by M. C. Cooke to the Royal Herbarium at Kew, is now for the most part incorporated with that great collection. The specimens are distributed as follows:

Hymenomycetes, about	11,000
Gastromycetes and Myxogasters,	2,000
Ustilagines and Uredines,	6,000
Discomycetes,	6,000
Pyrenomycetes,	12,000
Incompletæ,	9,000

The collection is a most valuable one, containing, as it does, contributions from many eminent mycologists, Berkeley, Curtis, Duby, Ellis, Fries, Leville, Montague, Peck, Ravenel, Rabenhorst, Winter, etc.

The Flora of Madagascar.—It may now be said with perfect truth that the vegetable productions of Madagascar have been, though not thoroughly, very extensively explored, and that the majority of the plants inhabiting the island are known to science. The country has been traversed by botanists in many different directions, its highest mountains have been ascended, its lakes and marshes crossed, its forests penetrated, and large collections of plants have been made from time to time, which have been examined and described in various publications. Our knowledge of the flora of Madagascar is due, in the first instance, to the labors of Flacourt, Dupetit Thouars, Commerson, Chapelier, Bernier, Lantz, Boivin, Pervillé, De Lastelle,

[19] Proc. Ac. Nat. Sc. of Phila., 1889., p. 50.